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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/844,626	04/27/2001	Elwin M. Beaty	60012US	2403

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EXAMINER
CHAWAN, SHEELA C

ART UNIT	PAPER NUMBER
2625	14

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/844,626	BEATY ET AL.	
	Examiner	Art Unit	
	Sheela C Chawan	2526	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 June 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-88* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-88* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Terminal Disclaimer

1. In response to applicant's terminal disclaimer filed June 12, 2003 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of (US.6,064,756, US. 6,064,757) has been reviewed and is accepted. The terminal disclaimer has been recorded. A new office action is being mailed out .

Claim Rejections - 35 U.S.C. § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103© and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-7, 9-29, 34- 43, 45-53, 56-60, 62-79, 81- 88, are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al.(US.5,859,924) in view of Shenghua Ye et al. " Vision -based system calibration for dimensional inspection ".

As per claim 1, Liu discloses a three dimensional inspection method for inspecting ball array devices having a plurality of balls, wherein the ball array device is positioned in an optical system, the inspection method comprising the steps of :

a) illuminating at least one ball on the ball array device (column 2, lines 59- 63);

b) disposing a sensor, a first optical element (fig 3, item 308) and a second optical element in relation to the ball array device (fig 3, item 304), so that the sensor obtains at least two differing views of the at least one ball, the sensor providing an output representing the at least two differing views (column 4, lines 6- 29); and

Regarding claim 1 Liu discloses method and system for measuring object features . The invention is directed to simultaneously collecting three-dimensional and two- dimensional data concerning features of an object and determine the dimension and relative positions of the features . Liu is silent about specific details of processing the output using a triangulation method to calculate a three dimensional position of the at least one ball with reference to a pre-calculate calibration plane . However, Shenghua Ye et al. discloses Vision -based system calibration for dimensional inspection .The system comprises of :

c) processing the output using a triangulation method to calculate a three dimensional position of the at least one ball with reference to a pre-calculate calibration plane (page 731 page 731- 732 , paragraph 1 , 2 system description and calibration

model and paragraph 3, calibration and measurement experiments), use of processing the output using a triangulation method to calculate a three dimensional position of the at least one ball with reference to a pre-calculate calibration plane because to produce reasonable accuracy in 3-D inspection page 731, abstract paragraph) .

Therefore , it would have been obvious to one with ordinary skill in the art at the time of invention to incorporate the teaching the step of using processing the output using a triangulation method to calculate a three dimensional position of the at least one ball with reference to a pre-calculate calibration plane as taught by Shenghua Ye et al 's into the system of Liu because one with ordinary skill in the art would realize that this modification would produce reasonable accuracy in 3-D inspection, as suggested by Shenghua at et. (page 731, abstract paragraph) .

As per claims 2 - 4, 25 - 27,49, 50 and 72 , Shenghua at et discloses the three dimensional inspection method wherein the pre-calculated calibration plane comprises a coordinate system having X, Y and Z axes and wherein a X measurement value is proportional to a Z measurement value (page 731- 732 , paragraph 2 system description and calibration model and paragraph 3, calibration and measurement experiments).

As per claims 5, 73, 83 -86, Liu discloses the three dimensional inspection method wherein the triangulation method is based on determining a center (column 3, lines 14- 32) of the ball in a first view and determining a ball top location in a second view (column 2, lines 64- 67, column 4, lines 6-26, 61- 63) .

As to claims 6, 28, 51 and 74, Shenghua at et discloses the three dimensional inspection method wherein the pre-calculated calibration plane is defined by measuring a calibration pattern (page 731- 732).

As per claims 7, 29, 60, 75 Liu discloses the three dimensional inspection method wherein the second optical element comprises a mirror (column 8, lines 28- 37)

.

As per claims 9 and 76, Shenghua at et discloses the three dimensional inspection method of claim 1, wherein one of the at least two differing views is obtained at low angle of view (page 732- 733 , fig 5) .

As per claims 11, 34, 58, 63, 78 and 88 Shenghua at et discloses the three dimensional inspection method wherein the sensor comprises a charged coupled device array (fig 1) .

As per claim 12, 35 and 59 Liu discloses the three dimensional inspection method wherein the sensor comprises a complementary metal oxide semiconductor device array (note, any sensor devices would comprises of a detection system which are made up of many metal oxide semiconductor array . These detection devices such as sensors has a characteristics and can be considered as a common feature of any such devices , column 2, lines 49- 58) .

As per claims 13, 38, 52 and 79 Liu discloses the three dimensional inspection method wherein the processing step further includes the step of applying gray scale edge detection to locate ball positions (column 3, lines 14- 32) .

As per claims 14, 39, 53 and 87, Liu discloses the three dimensional (column 9, lines 6- 12) inspection method wherein the processing step further includes the step of applying threshold analysis (column 5, lines 38- 61)

As per claims 15, 40 and 65 Liu discloses three dimensional inspection method wherein the first optical comprises a lens (fig 3, column 8 , lines 25- 31) .

As per claims 16, 41 and 66 Liu the three dimensional inspection method wherein the first optical element comprises a pin-hole lens, (note, optical system inherent has pin-hole lens , fig 3 column 8, lines 30- 37) .

As per claims 17, 42 and 67 Liu discloses the three dimensional inspection method wherein the first optical element comprises a plurality of lens elements, (note, optical system has plurality of lens , column 8 , lines 21- 36) .

As per claims 18, 43 and 68, Liu the three dimensional inspection method wherein the first optical element comprises a telecentric lens, (note, optical system inherent has telecentric of lens, column 18, lines 34- 37).

As per claims 19, 36,56 and 81 Liu discloses the three dimensional inspection method wherein the ball array devices comprise ball grid array devices (note solder ball or bump is considered as ball grid array, column 3, lines 16- 19, column 5, lines 18-19, column 6, lines 40- 42) .

As per claims 20, 37, 57 and 82 Liu discloses the three dimensional inspection method wherein the array devices comprise bump on wafer devices (note solder ball or bump is considered as ball grid array, column 3, lines 16-19, column 5, lines 18- 19, column 6, lines 40- 42) .

As per claims 21, 46 and 64 Liu discloses the three dimensional inspection method wherein the step of processing the output is carried out on a personal computer, (note, optical system inherently has a processor and computer, column 7, lines 43- 48)

.

As per claims 22 and 45 Liu discloses the three dimensional inspection method wherein the sensor includes a solid state sensor array (column 2 , lines 57- 58).

As per claims 23, 47, 62 and 71 Liu discloses the three dimensional inspection method wherein one of the views comprises a segment having a crescent shape (column 2, lines 10- 22) .

As per claims 24, 10, 48 and 77 recites similar limitations as claim 1 above and similarly analyzed except for the step as taught by Shenghua at et a three dimensional inspection method for ball array devices having a plurality of balls, the method comprising the step of :

b) disposing a sensor to receive light at a first angle relative to the ball array device (page 731- 732)

d) disposing a second optical element to receive light at a second angle different from the first angle and to transmit a second view of the ball array device to the sensor (page 731- 732 , Fig 1, 2 and 3);

f) processing the output using a triangulation method to calculate a three dimensional position of the at least one ball with reference to a pre-calculate calibration plane (page 731 page 731- 732 , paragraph 1 , 2 system description and calibration model and paragraph 3, calibration and measurement experiments) , use of

processing the output using a triangulation method to calculate a three dimensional position of the at least one ball with reference to a pre-calculate calibration plane because to produce reasonable accuracy in 3-D inspection page 731, abstract paragraph) .

Therefore , it would have been obvious to one with ordinary skill in the art at the time of invention to incorporate the teaching the step of using processing the output using a triangulation method to calculate a three dimensional position of the at least one ball with reference to a pre-calculate calibration plane as taught by Shenghua Ye et al 's into the system of Liu because one with ordinary skill in the art would realize that this modification would produce reasonable accuracy in 3-D inspection, as suggested by Shenghua at et. (page 731, abstract paragraph) .

3. Claims 31, 33, 44, 55 and 80 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al.(US. 5,859,924) in view of Shenghua Ye et al. " Vision - based system calibration for dimensional inspection ", as applied to the above claims 1-29, 31, 33-53, 55-60, 62- 88, and further in view of King et al.(US.6, 236, 747) .

Regarding claims 31,33, 44, 55 and 80 Liu discloses a method and system for measuring object features . Liu fails to specifically mention about illuminator comprises a ring light . However, King discloses system and method for image subtraction for ball and bumped grid array inspection where the ring illumination apparatus 20 includes a substantially ring -shaped light source 24 that generates light beams and directs the light beams into the field of view on the article , column 5, lines 41- 58). It would have been obvious to one with ordinary skill in the art at the time of invention to incorporate

the teaching of an illuminator comprises a ring light as taught by King 's into the system of S Liu . The motivation for doing so is to detect quickly and accurately absence/presence of the illuminated reflective elements, determines their position , and measures the size and shape , e.g. the diameter and circularity of any protruding object, if desired, as suggested by King at (column 3, lines 11- 15).

As per claim 47, Liu discloses the three dimensional inspection method wherein the second optical element reflects a view to the sensor where at least one ball of the ball array device exhibits a crescent shape (column 2, lines 10- 22) .

As per claim 48, the same limitations as set forth in claim 24 are contained as an independent claim (refer to claim 24, for common features) except for step of claim 48, recites f) processing the image information by applying triangulation calculation measurements of the image information so as to a three dimensional position of at least one ball with reference to a pre-calculated calibration plane , wherein the calibration plane comprises a coordinate system having X,Y and Z axes, and wherein an X measurement value is proportional to a Z measurement value (page 731- 732 , paragraph 2 system description and calibration model and paragraph 3, calibration and measurement experiments).

As to claim 69 is representative of claim 48 .

As to claim 70, is representative of claim 1 .

4. Claims 8, 30 and 61 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al.(US.5,859,924) in view of Shenghua Ye et al. " Vision -based system calibration for dimensional inspection ", in view of King et al.(US.6, 236, 747) , as

applied to the above claims 1- 7, 9-29 , 31, 33-53, 55-60, 62-88, and further in view of Svetkoff et al. (US. 5,617,209).

Regarding claims 8, 30 and 61, Liu discloses method and system for measuring object features . Liu fails to teach the optical element comprises a prism. However, Svetkoff discloses method and system for triangulation -based , 3-D imaging utilizing an angled scanning beam of radiant energy. The system comprises of a three dimensional inspection method wherein the second optical element (note, fig 8 consists of optical system , comprises a prism (column 11, lines 21- 26), use of optical device such as prism , because the system provides a method which improves the reliability and accuracy of the measurement system by providing a consistent lead orientation, thereby alleviating data reduction requirements (column 6, lines 19- 23).

Therefore, it would have been obvious to one with ordinary skill in the art at the time of invention to incorporate the teaching of step wherein the optical element comprises a prism as taught by Svetkoff's into the system of Liu because, one with ordinary skill in the art would realize that it improves the reliability and accuracy of the measurement system by providing a consistent lead orientation, thereby alleviating data reduction requirements, as suggested by Svetkoff at (column 6, lines 19- 23).

5. Claims 32 and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al.(US.5,859,924) in view of Shenghua Ye et al. " Vision -based system calibration for dimensional inspection ", in view of King et al.(US.6, 236, 747) , in view of Svetkoff et al., (US. 5,617,209), as applied to the above claims 1- 31, 33 - 53, 55-88 , and further in view of Roy et al., (US. 6,118,540).

Regarding claims 32 and 54 Liu discloses method and system for measuring object features . Liu fails to teach step of illuminating with a plurality of light emitting diodes . However, Roy discloses method and apparatus for inspecting a work piece. The system comprises of the three dimensional inspection method wherein the step of illuminating comprises the step of illuminating with a plurality of light emitting diodes (column 2, lines 52- 63) , use of plurality of light emitting diodes, because to provide appropriate coverage of the object (column 2, lines 52- 63).

Therefore, it would have been obvious to one with ordinary skill in the art at the time of invention to incorporate the teaching of step of illuminating with a plurality of light emitting diodes as taught by Roy's into the system of Liu because, one with ordinary skill in the art would realize that having more light emitting diodes can provide an appropriate coverage of the object , as suggested by Roy at (column 2, lines 52- 63).

Contact Information

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sheela C Chawan whose telephone number is 703-305- 4876. The examiner can normally be reached on Monday through Thursday 7.30 a.m. to 6.00 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta, can be reached on (703) 308 - 5246. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9314.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-9700.

Jayanti K. Patel
Primary Examiner

scc

Sheela Chawan
Patent Examiner
Group Art Unit 2625
August 21, 2003